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AUTHOR Adams, James M.
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ABSTRACT

Factor analysis is a statistical method of reducing a set number of variables by finding similarities between them. This paper reviews the potential of factor analysis, focusing on exploratory factor analysis, in research on psychotherapy. Within the field of psychotherapy, the use of factor analysis can be classified into three groups. The first group of research studies deals with training and professional issues. Another set of studies has considered process in therapy. The third use of factor analysis in psychotherapy research is in measurement research, by far the largest use of factor analysis in psychotherapy research. Both two-mode factor analysis and higher order factor analysis can be used in psychotherapy research. Factor analysis is a valuable research tool that can reduce the object of interest to more manageable and parsimonious terms. (Contains 35 references.) (SLD)

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Creative Uses of Factor Analysis in Psychotherapy Research:

Past Examples and Future Possibilities

James M. Adams

University of Southern Mississippi

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Introduction

Factor analysis is a statistical method of reducing a set number of variables by finding similarities between them. This statistical method was proposed first by Pearson and Spearman in the early 1900's (Kieffer, 1999). Since it's conception, factor analysis has become wide spread in the development of psychological theory and method. Kieffer (1999) commented that "The utilization of factor analytic techniques in the social sciences has been indelibly intertwined with developing theories and evaluating the construct validity of measures." (P. 75) Factor analysis can be divided into two techniques or purposes: exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). EFA attempts to decipher the factors in a set of variables. In essence, it attempts to simplify a set of data. On the other hand, CFA attempts to confirm or test and already established set of factors of a data set. While CFA has become more prominent in psychological theory development recently, EFA still remains the most prominent method of developing psychological theory.

Tinsley and Tinsley (1987) reviewed the uses of factor analysis in counseling psychology in an important Journal of Counseling Psychology issue covering quantitative methods in counseling psychology research. In their review, they stated that factor analysis gives valuable flexibility in quantitative study. It is most popularly used to validate and develop testing instruments such as the Missouri Addressing Resistance Scale (Kivlighan et al., 1996). It is also applied frequently to the development of constructs in theory. However, factor analysis has been shown to possess the capability to study a wide variety of sources of information such as counselor philosophies (DiGiuseppe & Linscott, 1993; Neimeyer & Morton, 1997), content of interviews (Fry, 1984), vocational interests (Fouad, Cudeck, & Hansen, 1984), and professional

opinions (Gustafson et al., 1992).

The purpose of this paper is to investigate the application of factor analysis (prominently EFA) to psychological theory development pertaining to psychotherapy. Strupp (1978) roughly defined psychotherapy as "an interpersonal process designed to bring about modifications of feelings, cognitions, attitudes and behaviour which have proved troublesome to the person seeking help from a trained professional" (p. 3). Kazdin (1986) and Karasu (1986) speculated that over 400 different therapies existed within the applied field of psychology. Therefore, there is a great need for the simplification of theory and psychotherapy within this expanse field of social science. Factor analysis has become quite prominent in part due to this need to find some semblance of cohesion and integration. This paper is designed to be an impetus for the creative use of factor analysis in applied psychotherapy research. Therefore, I will review a small sample of past research examples in the psychotherapy realm. In addition, future possibilities for the use of factor analysis will be covered. First, however, a conceptual explanation of the creative extension of factor analysis will be discussed covering higher order factor analysis and two-mode factoring.

Higher Order Factor Analysis

Higher order factor analysis is an exploratory technique in which the first factors extracted from a data analysis, called first order or primary factors, are then factored in order to extract "higher" factors. In essence, the factors themselves are the data being factored in order to yield less narrow or more global grouping and to simplify the first analysis. For example, an intelligence test with many subtests or variables may yield a series of factors that categorize and group the many subtests. However, the research may be interested in whether the groups

themselves factor even further into larger groups. The data may eventually factor into one higher order factor. In the previous example, the highest order factor may be a general intelligence. The higher order factors are named by their levels: second order, third order, fourth order, etc. The main conceptual difference between the orders of factors is that as the order rises, the specificity or accuracy lowers but the generalizability increases and vice versa (Gorsuch, 1983).

Essentially, this data analysis is performed much like a standard EFA. However, there are some key differences. First, a standard EFA is performed on the data set to extract the factors. Next, the resulting matrix is rotated obliquely (such as Promax) in order to reveal inter-correlations between the factors. Then another EFA is performed on the factors themselves. This process is continued until either only one factor can be extracted or the factors no longer correlate.

Interpretation for higher order factor analysis can be difficult because one cannot base the interpretations of the higher orders on the results of the first order factors. Essentially, the variance explained by the first order factors would then be interpreted two times. In other words, the first order factors explain a certain percentage of the variance within the data set. By factoring the first order factors in order to extract higher order factors, the same proportion of variance explained is being used in the analysis. In order to not interpret the same variance twice, standard interpretation tools in EFA cannot be used. Neither can sample based significance testing be done, such as chi square statistics. The sample used in higher order factoring is the factors themselves which does not represent the data's true sample. For example, a data set being factored may have an N = 200 and yields six factors. Therefore, the second order factoring would then have an N = 6. Therefore, the sample concept is meaningless in higher

order factoring.

In order to interpret the higher order factors, Gorsuch (1983, p. 245) stated, "To avoid basing interpretations upon interpretations, the relationships of the original variables to each level of the higher-order factors are determined Then the interpretations are based upon relationships with the variables as well as the relationships to the primary factors." Therefore, determining the theoretical relationship between the higher order factors and the primary factors is as important as understanding the theoretical relationship between the primary factors and the variables themselves.

However, there are statistical methods for determining factor contribution. First, Gorsuch (1983) proposed that the first order pattern matrix can be multiplied by the orthogonally rotated higher-order factor pattern matrix using matrix algebra. Thompson (1990) has developed a computer program called SECONDOR designed to complete this task. Thompson (1990) also proposed that Gorsuch's method be applied but stipulated that the resulting matrix should then be rotated orthogonally. A final approach is called the Schmid-Leiman method. This approach residualizes the variance from the first-order factors in order to show the unique variance that is explained by the higher-order factors. In others words, it makes the first order and second-order factors orthogonal to each other.

Two-Mode Factoring

In factor analysis, the rows and columns imbedded within the data set are many times referred to as "dimensions" (Gorsuch, 1983). However, the term "mode" is also many times used, referring to the two distinct variables that are used in the analysis. As discussed before, the variables to be factored can be highly variable, including the ability to factor the first set of

factors. Henceforth, nearly every type of observation, variable, item, etc. can be factored using factor analysis. In other words, factor analysis is not limited to the factoring of observations across several variables. The factoring of non-traditional modes has been referred to as "alternative two-mode" techniques and was first proposed by Sir Cyril Burt in 1917 (Campbell, 1996). Burt suggested that people, rather than variables, could be factored.

Several other methods of factoring non-variables and other variations have since been developed. The traditional method of factor analysis, that is the factoring of variables from many individuals' data from one occasion of data collection, is called the R-technique. Note that all the factor analytic methods exist across three dimensions, a phenomenon which Cattell called the data box. The three dimensions of factor analysis include the rows, columns, and the model being held constant. For example, R-technique factors variables (columns) of data from individuals (rows) at one point in time (mode held constant). Each of the two-mode techniques have three modes, of which one is held constant. Within the same facet, P-technique also factors variables but the data is from one individual (mode held constant) across many occasions (rows). This is the factor analysis version of the single case design. The purpose of such an analysis would be to look for traits within an individual. For example, a child may be given several measurements (variables) of aggression across several periods of time in order to look for general traits and associations between the measurements.

Q-technique and S-technique factor individuals as suggested by Burt (Campbell, 1996). Q-technique factors individuals from one occasion or period of time (mode held constant) across many variables (rows). In this technique, the researcher is looking for types of individuals or similarities of individuals across the various variables. For example, a researcher may give a

sample several measurements of depression and associated phenomenon in order to find qualitatively different categories of individuals. Conversely, S-technique factors individuals across various occasions (rows) but only for one variable of interest. Using the same example, the researcher may only use one measurement of depression but at several points of time to assess depression across time. The researcher is still interested finding categories of people, but now with a different way of assessing depression.

O-technique and T-technique factor the occasions or conditions rather than the individuals or the variables. These two techniques are the least common, but represent a drastically different approach to research (Gorsuch, 1983). Most research designs will collect data from only one point in time. Granted, repeated measure designs are able to examine change over time, however, there is a limit on the number of moments in time. O-technique factors occasions that are all from one individual (mode held constant) across several variables (rows). This is another variation of the single case design which seeks to find similarities between periods of time or situations/environment. For example, a school psychologist may want to know why child is arguing with other kids. Therefore, the psychologist can collect data from several measurements in several environments and factor the environments to look for similarities. T-technique factors occasions from one variable (mode held constant) across several individuals (rows). The method seeks to find similar situations, environments, or times but rejecting the N = 1 design. Rather, the method uses only one measurement to provide the data. Therefore, the psychologist may want to investigate the arguing for the entire class. However, only one measurement is used: arguing frequency.

Psychotherapy Research and Factor Analysis

The use of factor analysis within the field of psychotherapy can be classified into three groups. The first group of factor analysis research in psychotherapy deals with training and professional issues. Using this technique, the lense of investigation is turned inward and the people under investigation are the psychologists and training programs themselves. Next, process in therapy is many times analyzed using factor analysis. A growing body of research and interest in psychotherapy has begun to focus on the process by which change occurs in therapy (Nelson & Poulin, 1997). Factor analysis seems well suited for this examination. The third grouping of factor analysis research is in measurement research. This third group is by far the most prominent use of factor analysis in psychotherapy research. The measurement devices are then used to assist assessment, treatment planning, and therapy outcome assessment. Each of these three groups will be briefly reviewed.

Training/Professional Issues. As discussed before, an enormous amount of therapy techniques are used within this diverse profession. Some of these therapeutic theories are more widely used than others. However, psychotherapy theorists have proposed that certain philosophies exist across the vast expanse of psychotherapy theories (Hayes & Oppenheim, 1997; Lyddon, 1989; Neimeyer, 1995; Steenbarger, 1991). In other words, there may be over 400 theories but they all possess certain philosophical tendencies and categories. Therefore, the total number of philosophies has been proposed to be four (Lyddon, 1989) or even two (DiGiuseppe & Linscott, 1993; Neimeyer & Morton, 1997).

A fair amount of factor analytic research has gone into studying these different philosophical frameworks. DiGiuseppe and Linscott (1993) developed the Therapist Attitudes Questionnaire for the purpose of finding these possible philosophical differences. In their study,

they discovered that even therapists within a particular theoretical framework possessed differences in philosophies. These results perhaps suggest that it is philosophical variation which guides difference in therapeutic technique rather than theoretical differences. Neimeyer and Morton (1997) used the Therapist Attitudes Questionnaire as well and found similar results. However, this research is not unusual in that they used classic R-techniques: factoring items on a test across many individuals for one occasion. However, the instrument is interesting in that it is given to various samples with the expectation to find differences in factors.

Factor analysis methods are also used to understand the composition of opinions within the field of psychotherapy. Schoen (1989) used factor analysis to look at the value systems counseling psychologists in Australia in order to compare with American psychologists. The data compiled was a series of ratings of various activities. The various activities were then factor analyzed to extract their professional values. Williams, Coyle, and Lyons (1999) had psychotherapists who were themselves receiving personal therapy rate various components found to be valuable in therapy. A factor analysis of those components revealed 3 factors that the psychotherapists most valued in therapy.

Flathman (1999) used factor analysis to determine how psychologists view delayed memories. The delayed memory debate has suggested that individuals are polarized: either for or against the use of delayed memories. Flathman challenged this notion by factor analyzing Q-sorts, of existing perspectives on delayed memories, completed by respondents. The analysis did not reveal two factors but instead five distinct factors. Feigon and de Rivera (1998) has also used factor analysis to study professional views of delayed or recovered memories. In the study, two groups of psychologists had factor analyses performed separately to detect differences in factor

extraction. The differences in factor extraction suggested that psychologists who specialize in this area were more "risky" when they used a particular technique involving delayed memory.

Factor analysis has also shown it's usefulness in informing training. The value of training in particular theoretical orientation has been studied (Elizur, Kretsch, & Speiser, 1997) as well as training in particular programs (Stevens, Dinoff, & Donnenworth, 1998). Emmerson and Thackwray (1992) even suggested that factor analysis as a conceptual tool can be useful to therapy. They suggested that principles of factor analysis could be used theoretically to assist in clinical case conceptualization.

Note that while higher order factor analysis was not evident in all of the research reviewed in the previous section, the factors yielded in the research could have been easily factored into higher orders. As previously discussed, higher orders are more generalizable but less specific. Due to the exploratory nature of professional and training analysis, higher orders were not of interest. Nevertheless, wide variety of items and sources of data were factored in the previous examples. However, therapeutic process research requires more creativity in order to study the objects of interest.

Process in Therapy. Due to a growing dissatisfaction with outcome research and it's applicability to actual practice, psychologists began to urge research focusing on the process of therapy rather than the outcome (Goldfried & Wolfe, 1996). Since this rather recent development, factor analysis has become involved in some of the process research. The most common usage of factor analysis in psychotherapy process is to better understand specific trends in certain populations. Sumerlin and Privette (1994) applied a humanistic framework to homeless men. The assumption is that homeless people would not respond well to self-

actualization needs, lacking basic necessities. Sumerlin and Privette factor analyzed scores on a self-actualization index in addition to demographic information surrounding homelessness. The analysis extracted nine factors that indicate relevance to counseling and actualization needs. In this example, factor analysis is informing practice by categorizing and simplifying the needs of a certain population. Factor analysis has also been used to explore factors involved in motivation (Rosenbaum & Horowitz, 1983), incarceration (Eaker, Allen, & Heckel, 1983), and therapeutic alliance (Hatcher et al., 1995; Hatcher & Barends, 1996).

Psychotherapy process research has seen a fair amount of the P-technique used to study individuals in therapy or treatment. This method is a form of "single case design" and has been applied to case studies for almost fifty years (Luborsky, 1995). As discussed before, the P-technique factors variables across occasions (places, times, etc.) while holding the individual constant. In other words, all of the variables and occasions are generated by one individual; in this case, the client. Russell, Bryant, and Estrada (1996) factored a number of process measurements (Loyola Child Psychotherapy Process Scales for example) across 35 child therapy sessions. The sessions acted as the occasions; tapes coded using the measurements. This was able to extract factors that indicated various stages of therapy. In addition, the sessions that were high and low quality were identified using the factor analysis. Czogalick and Russell (1995) factored several variables across several therapy session for an individual. Their results suggested several categories of language and interaction which constitute various stages of therapy. The authors stated that P-technique is an extremely valuable method for revealing the structures in therapeutic discourse.

Assessment. Construct validation in assessment tools is an important and noble deed

indeed which includes factor analysis. Factor analysis is also used in the construction of the subtests and scales. However, the effect on psychotherapy is indirect. Assessment tools are used in psychotherapy, but the factor analysis itself is not used to study psychotherapy. Therefore, while this qualitative group within psychotherapy literature comprises the largest group, it is limited in it's creativity and applications. Suffice for this discussion is to state that literally every reputable assessment tool in psychotherapy has undergone some sort of factor analysis either in it's development or validation. However, other rather new assessment tools for psychotherapy can always be found; such as the Missouri Addressing Resistance Scale (Kivlighan et al., 1996) and the Inventory of Interpersonal Problems (Horowitz et al., 1988) for examples.

Future Possibilities for Factor Analytic Psychotherapy Research

Psychotherapy has been heralded as one of the most difficult forms of science to study (Roth & Fonagy, 1996). Factor analysis provides a powerful addition to use in psychotherapy research. However, factor analysis is not used quite as much as would be expected. Even if factor analysis is used, typically the R-technique is used and no higher order factors are extracted. Therefore, I will briefly discuss some possibilities for using two mode techniques and higher order factoring in psychotherapy research in the interest of stimulating it's use.

First, the single case designs for factor analysis are enormously powerful for examining the therapeutic dialogue as indicated by Luborsky (1995). As with all single case designs, the value is evident in their power. The researcher is not looking at differences between individuals rather the research is looking at similarities within the individual. Any single case design is weak in generalizability. However, a clinician may not be interested in any other individuals other than the client. From this perspective, the O and P techniques are extremely valuable to a clinician

working with a difficult client; in actual statistical practice as suggested by Luborsky (1995) or in theory as suggested by Thackwray (1992). In addition, the generalizability problem can be at least partially addressed by finding higher order factors.

The Q and S techniques have numerous possibilities in the study of not only categories of clients but groups of individuals who may respond more favorably to certain kinds of therapy. In other words, some individuals may respond well to one kind of therapy but not to others. Q and S techniques provide a viable option for classifying individuals into which theory may suit them best. In addition, Q and S techniques provide a possibly more valuable method of studying professional grouping or allegiance to a particular school. The articles reviewed in this paper used the standard R-technique to look at the factors: values and philosophies. However, the studies would have yielded possibly more information if the individuals themselves would have been factored rather than the variables.

Furthermore, factor analytic techniques can be used to examine the field of psychotherapy on an academic level. In order to better understand this possibility, an example will be provided. Current theorists in psychotherapy and counseling theories suggest that the field of counseling and the accompanying literature has experienced drastic changes of one philosophy to another over time (Hayes & Oppenheim, 1997; Neimeyer 1995). This phenomenon was first recognized by Kuhn (1970) who termed these changes "paradigm shifts." The paradigm shift would encompass both research and practice directions, as well as scientific jargon. Each paradigm or qualitative philosophy uses many idiosyncratic jargon which can be detected in the literature base of the time. These terms can be factored to detect the presence of the global philosophy and, more importantly, the time in which the paradigm shift occurred. Essentially, factor analysis can

investigate whether or not the paradigm shift actually occurred and at what time.

Qualitative designs have also become more prominent in the study of psychotherapy. Qualitative designs make a distinct change in research design by rejecting the idea that all research requires data and numbers (Nelson & Poulin, 1997). The qualitative design uses the narrative or language discourse as the object of study. This will many times include interviews. Factor analysis provides a good medium between the two research methods. The data used in factor analysis are many times narratives or interviews such as in Russell, Bryant, and Estrada (1996). I essence, the phenomenological design uses a form of factor analysis in which the researcher attempts to place the interview units into factors and then higher order factors (Nelson & Poulin, 1997). Perhaps factor analytic designs could quantify the process some but still yield the desired information.

Factor analysis is a valuable research tool that can reduce the object of interest into more manageable and parsimonious terms. Essentially, anything can be factored, pending that similarities can be found within the units. While this paper has not reviewed the technical and statistical aspects of factor analysis, I hope that this paper has stimulated a renewed interest in it's multiple uses. As Tinsley and Tinsley (1987, p. 414) state, " Given the flexibility of factor analytic techniques, it is important for counseling psychologists to be knowledgeable about factor analysis."

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